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FROM THE MAKERS OF WOLFRAM LANGUAGE AND MATHEMATICA
WolframAlpha

$$\sum_{n=1}^{\infty} \frac{\sin n}{n^s}$$

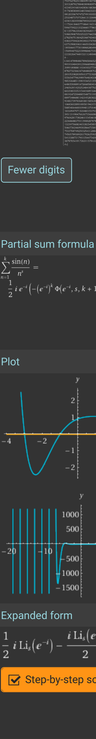
Input interpretation

$$\sum_{n=1}^{\infty} \frac{\sin(n)}{n^s}$$

Result

$$\frac{1}{2} i \left(\mathrm{Li}_s\left(e^{-i}\right) - \mathrm{Li}_s\left(e^{i}\right)\right)$$

Infinite sum

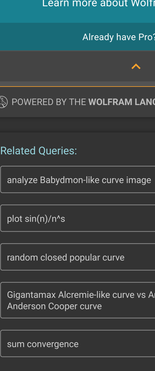


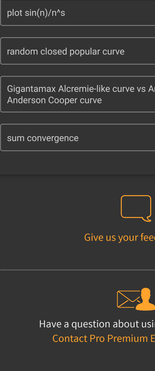
Fewer digits

Partial sum formula

$$\sum_{n=1}^{k} \frac{\sin(n)}{n^s} = \frac{1}{2} i\, e^{-i} \left(-\left(e^{-i}\right)^k \Phi\left(e^{-i}, s, k+1\right) + e^{2i} \left(e^{i}\right)^k \Phi\left(e^{i}, s, k+1\right) + e^{i}\, \mathrm{Li}_s\left(e^{-i}\right) - e^{i}\, \mathrm{Li}_s\left(e^{i}\right)\right)$$

Plot





Expanded form

$$\frac{1}{2} i\, \mathrm{Li}_s\left(e^{-i}\right) - \frac{i\, \mathrm{Li}_s\left(e^{i}\right)}{2}$$

Step-by-step solution

Wolfram|Alpha Step-by-step solution

Expanded form:

STEP 1

Expand the following:

$$\left(\frac{i}{2} \cdot 0\right)\left(\mathrm{Li}_s\left(e^{2i \cdot 0}\right) - \mathrm{Li}_s\left(e^{2i \cdot 0+1}\right)\right)$$

Hint: Distribute i over $\mathrm{Li}_s\left(e^{-i}\right) - \mathrm{Li}_s\left(e^{i}\right)$

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